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AUTHOR Gray, Peter J.
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ABSTRACT

This manual on microcomputer-based database management programs provides a description of the key characteristics of database software as well as guidelines for designing a database, uses of database programs, and selecting the right software. Three sets of concepts related to database management are listed and explained: creating a database, using a database management system, and generating reports from the information in a database. Specific directions elaborate on each concept, i.e., generating a master list of fields for use as a guide to selecting an appropriate software program, use of default systems, search strategies, and use of four different formats in creating a report (page format, data format, sort format, and select format). A six-step process is recommended for designing a database: (1) determine goals; (2) specify the data needed; (3) design the reports; (4) set up the database; (5) revise; and (6) pilot test. A list of eight sample uses for database programs includes: personnel records, study participant records, test item banks, equipment and supply logs, contact and activity logs, financial statements, consultant records, and references in the literature. A seven-step process is also suggested for evaluating individual software programs. (JB)

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Guide Number 7

MICROCOMPUTERS: DATA BASE MANAGEMENT SOFTWARE

Peter J. Gray

The use of microcomputer-based data base management programs is discussed, including:

- Key Characteristics of Data Base Software
- Designing a Data Base
- Uses of Data Base Programs
- Selecting the Right Software
- References

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KEY CHARACTERISTICS OF DATA BASE SOFTWARE

A microcomputer data base may be thought of as an electronic filing system. Like a paper filing system, a data base consists of a consistent set of records. Each record is a completed form and on each page of the form there is specific information. The items of information on the page are called fields. All together the fields of information make up a record. A file is a collection of completed records all with the same fields.

In less powerful data base programs, the number of fields that a record can contain is limited, sometimes to 24 or fewer fields. In addition, in many cases only one file of information can be used at a time. Therefore, in these systems each page of the record may have quite different fields of information. For example, the first page of an evaluation study subject data base might have fields which contain an identification number, the subject's last name, first name and middle initial, educational data such as grade in school, sex and racial data, and any other demographic information needed. The second page of a subject record may have a set of test scores or other psychometric data collected over time. The third page may have information like parental education and other parent demographic data. By having all of the information about each case in one file, these file management systems can emulate some of the features of true data base programs which can access many files at once.

There are, in fact, programs that allow many fields in each record, for example, up to 100. Because so much information is in one file, these programs can do many of the things that true data bases can do with their ability to access different files. The major limitation of these programs is the amount of time needed to search for information and to sort records for the purpose of reporting. In many cases the information in the file is stored in the form of independent records, although there may be a limited numbers of keys created which help to organize the records around particular attributes. However, many manipulations, such as sorting records in the creation of reports, must still be done by examining each record.

More powerful data base programs have the ability to use information from two or more files at the same time. The records in each file may be limited in the number of fields allowed, much like in file management programs. However, where diffent types of information are put on each page of a single record in a single file in a file management program (e.g., subject demographics, psychometric data, parental information), these pages would become separate files in a true data base program. In addition, each file could have as many fields as the whole record in simple file management systems.

Even more important than the amount of information stored in a single record is the way the data base as a whole is organized. In the more complex data bases, each record is related to all of the other records. This allows the quick location of information within the data base and the quick organization of specific fields for the purpose of reporting.

File management and data base programs usually limit the size of a field to less than 256 characters or the record to less than 1000 characters. That is adequate for most applications, but not if more than a sentence is required for any one field. A text-oriented data base allows fields to be a single word or a whole page. It is usually possible to search such data bases on key words, for example, a particular topic, author, or title. These data bases are well suited for maintaining research notes, observations of students or staff, or bibliographies.

Let's look at the general characteristics of data base management programs.

Function:	Facilitates the storage, retrieval, and reporting of information
Programs:	pfs FILE, DB MASTER, dBase II
Advantages:	Handles many kinds of information Very flexible - can be used to create many different files (e.g., files of subjects, references, notes, equipment, addresses) Easy to maintain information by editing, deleting, updating, sorting, and indexing records Can be used to retrieve information about individual records or about groups of records meeting certain criteria
Disadvantages:	Requires considerable time to set up Requires time to learn to operate the more complex programs Limited statistical analysis Requires trained personnel to maintain the data base

There are three sets of concepts related to data base management that will help you understand what data bases are and what they do. One set concerns creating a data base. Another set has to do with how to use a data base management system. And the third set concerns generating reports from the information in a data base.

Creating A Data Base

The first step in creating a data base is to design the file or files, that is, to specify the fields, pages and form of each record. The second step is to actually create it using a particular data base software program. As noted in the list of characteristics, both of these steps will take considerable time and effort.

The best way to begin the design of a data base is to closely analyze the current filing system that you wish to transfer to a microcomputer, or, if you do not have a current example, then examine a system that is as similar as possible. The best place to start is with the reports that have been generated using the old system. The column and row headings of the reports will tell you the types of information that will be required of the system, including any fields computed from the combination of other fields, subtotals, totals, and statistical summaries.

The next place to look for the fields needed in your data base is the paper form(s) used to collect information. Paper forms can give you an idea of the fields of the file and of the way people are used to gathering or providing information.

Files are also used for inquiries that may never result in a report. Therefore, it is important to talk with those people who have access to a file to find out what information they seek regarding either individual records or groups of records. At the same time, they can give you insights as to additional information that might be included in a file and additional reports that may help them in their work.

From your analysis, a master list of fields should be generated. Each field should have a short name. The file fields should be broken down into the following types: numeric fields, alphanumeric fields, and special fields (e.g., social security number, telephone, dollars and cents, yes/no, and dates). Any of these fields that are to be used as key fields in the organization of the data base should be so designated. It is also important to identify fields that are to be used to compute other fields or that are themselves computed. Finally, fields representing subtotals and totals and statistical summaries should be identified.

This list of fields can be used as a guide to selecting an appropriate data base software program. A program must be able to accommodate the total number and the variety of fields that you need. And, it must be able to produce the computed, total, and statistical fields needed in the form of a report that you find useful.

It is critical to try out several of the most likely programs before purchasing one. Take your list of fields to local vendors or friends who are familiar with data base management programs and ask them what programs are candidates for meeting your needs. The programs listed later in this column are representative of the range of programs available. Several of the articles listed under the references contain extensive summaries of data base management programs, too. The important point is to try before you buy!

The next step in creating a data base is to actually set up the fields using a software program. Each software program will have its own way of creating a file. The process of file creation can be as simple as laying out each screen page as you want it to appear for data entry. In this case, the program sets up the file structure. At the other extreme is the program where you have to specify all of the fields and their characteristics and then also go through the process of creating input screens. In some cases you must use programming language to create the desired result. Your master list of fields and their characteristics will guide the setting up of a file no matter what the particular requirements of a program are.

Using a data base

Once a file has been created it may be put to many uses. The initial use is to add records. Of course, prior to adding records, the information for each field must be collected. The design of the paper form(s) used in initial data collection is just as important as the design of the data base itself, since without a good data collection process, the old computer addage, "garbage in, garbage out," will apply.

There are two features that must be considered in anticipation of using a data base. One is the ability of the program to check the accuracy of the information entered, and the other is the way security of information is maintained. Some of the less sophisticated programs do not even check to make sure a number and not a letter is being entered into a numeric field. More sophisticated programs allow the developer to specify a range of acceptable values for each field against which it will check incoming data. Security is typically maintained through the use of passwords. When maintaining test scores or other appropriately confidential information, it is often important to use a program where certain fields are hidden from the view or are not changeable by people with a particular password. Such a system can get cumbersome because of the need to change passwords as staff members change.

When adding records, the program will typically display a blank first page of the data base form. Remember, this screen form should be as similar as possible to the paper form used to collect information. The user simply begins entering the information field by field. Let's look at a couple of ways to save time when entering information into a data base.

There are times when you will not want to enter all of the information in a data base at once. An example might be when the test scores from the second year of a five-year program are ready. It would be a waste of time to have to move page by page and field by field through a form to get to the appropriate place. Instead, it is possible to extract just those fields needed to identify each record (i.e., the primary key) and those fields that need to be changed, putting them together into an abbreviated form. When data are entered and saved, they are inserted into their proper place in the larger record.

Another way to speed data entry is to use default values. These can be specified at the time the data base is first created. Default values are those that will be used again and again, for example, a particular telephone area code. In other cases, temporary default values might be specified when a set of records are being added, for example, all of the reading scores for the third-graders in Crest Drive School. A good data base management program will facilitate the entry of data by allowing you flexibility in formatting the pages in your form, by giving you the option of creating short forms, and by providing you with the ability to set both permanent and temporary defaults.

After records have been entered, it is then possible to search for a particular record or a given set of records. In some programs, an extensive list of options for searching the data base is available. For example, you may wish to search for records which fall within a certain range, such as Aa to Cz. Or there may be a need to find all of the records which start with a particular prefix, such as NWRELXXXXX. Sometimes records with a particular string of letters or numbers are desired, as in a search for all of the materials which include the word microcomputer. When the exact spelling of a word is not known, a search can be conducted which will find any word that has all the letters except the unknown ones (e.g., GR?Y). All of the relational signs and their various combinations (e.g., greater than, equal to, less than) can also be used to direct a search.

Often these different types of searches can be linked together by an AND or an OR condition. For example, you might want the program to find records which fall into either of two discontinuous ranges. In this case you would simply indicate the first range and then link it to the next one with an OR statement.

Having found an individual or group of records, it is then possible to edit or delete them. Deleting simply removes the record from the data base. Of course, you must be sure that you want the record deleted. It is often a good idea to have archive files of old versions of a data base with records that have since been deleted, just in case you wish to retrieve them at some later date.

Editing a record means correcting, updating, or adding information. Using a short form is a convenient way to edit records. For example, a short form that just has grade level, new classroom assignment, and end of the year test scores can be used to quickly update student records. Often you may want to send the edited record directly to a printer so that you have a typed copy. There are, however, more sophisticated ways to print out the information in a data base.

Printing Reports

Generating an interesting and informative report is one of the most exciting and rewarding uses of a data base management system. There are four different formats that have to be specified in creating a report, namely, page format, data format, sort format, and select format. They form the column headings for the following table with their respective sub-formats falling under each heading.

Print Report Formats

Page Format	Data Format	Sort Format	Select Format
page numbering	comment lines	sort fields	record chacteristics
report dating	column titles	subtotal break fields	(range, includes,
lines/page	computed fields	page break fields	starts with,
continuous/ single sheet	data fields	(column totals)	relationals,
lines between records	comment fields		AND / OR conditions)
labels	horizontal sub- & grand totals		
	record numbering		
	code fields		
	report width		

Creating a good report takes as much planning as setting up the data base to begin with, but once it is created you can use it and/or its parts again and again.

In summary, data base management packages are one of the more useful tools available in the microcomputer toolbox. A good strategy for learning how these programs work is to start with a simple file

management program. As you gain experience in designing more complex data base applications, you will outgrow these programs and will be ready for a package with the capability to meet your new needs.

DESIGNING A DATA BASE

To design an application, try the following process:

1. Determine your goals. Be clear about what you want to accomplish with the data base. Use familiar paper files as your starting point.

2. Specify the data needed. Sketch the types of reports you expect from the data base. Develop a list of needed fields. Consider the requirements of each field.

3. Design the reports. Refine the sketches of reports and layout on graph paper.

4. Set up the data base. Enter the data base as you have designed it. Enter some sample cases and format some simple reports.

5. Revise. Learning from your initial mistakes, start over with an improved design. Repeat as necessary. Now format the standard reports you designed.

6. Pilot test. Use the data base on real data for a period of time. Manually confirm that the results are correct. Plan on revising again.

USES OF DATA BASE PROGRAMS

Data base programs can be used for any purpose that manual files are used including the creation, management and summarization of:

- personnel records
- study participant records
- test item banks
- equipment and supply records
- contact and activity logs
- financial statements
- consultant records
- references in the literature

SELECTING THE RIGHT SOFTWARE

In one sense, hardware requirements are the first characteristic of a program that should be considered and, in another sense, they are the last. From a realistic point of view, the first criteria for selecting a program is whether it will run on a machine you already have, or on a machine that you feel you can afford to buy for statistical and other purposes. However, within these general constraints, hardware becomes a secondary consideration, because there is a variety of good programs to choose from for most of the popular and widely used machines with operating systems such as Apple DOS 3.3, IBM-PC DOS or MS-DOS, and CP/M. Within each group, programs vary in terms of their sophistication and cost and in terms of the specific hardware system characteristics that they require.

In summary, if a commitment has already been made to purchase a particular machine, or if there are special budget limitations, hardware-related requirements are the first features of a program that should be considered. However, if there are no rigid constraints, it is best to ignore these requirements for the time being and move on to the other more substantive features of data management programs.

It is important to evaluate a program in terms of its versatility regarding those features you need most. Selection may come down to the program(s) with the best ratings on those features of greatest importance as opposed to those with the best over-all ratings. This notion of the highest ratings on the most important features is worth considering. Sometimes pricing, especially in regard to multiple copies, is the deciding factor among programs of generally equal ratings. In other cases it may be that speed, error handling, and versatility (i.e., program performance) is more important than either ease of use or support. Therefore, lower ratings in these areas would not disqualify a program if it was a strong performer.

Using the information provided in this guide will help you to judge the quality of individual programs. The procedures also provide a way to compare programs in a consistent manner.

Any combination of features is possible. Selection should be based, therefore, on a consideration of the combination of features most desired for the types of tasks to be performed using the program.

In order to make a sound choice:

1. Describe your use(s) - what will you use the program for?

2. Identify the features you need - what do you want to be able to do?

3. Plan ahead for new needs - what are you likely to want a year from now?

4. Consider constraints - What price range, hardware (e.g., machine type, printer features) and user preferences are you limited by?

5. Put features into a rough priority list - which are the most, somewhat, and least important features?

6. Try out and compare products - who has the features you need and want within your constraints?

7. Remember support - will there be someone you can talk to if there are problems after you buy the program?

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12A

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Research on Evaluation Program
Northwest Regional Educational Laboratory
300 S. W. Sixth Avenue
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